FIGHT'S ON!

Quarterly Newsletter from the Warfighter Training Research Division (AFRL/HEA)
of the Air Force Research Laboratory Human Effectiveness Directorate

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Joint Special Event Highlights Training

The Interservice/Industry Training Simulation & Education Conference (I/ITSEC) 2003 at the Orlando, FL Convention Center was the site of a DoD Special Event highlighting Distributed Mission Operations (DMO) capabilities. With the US Navy as lead Service, Naval Air Systems orchestrated *Operation Virtual Freedom,* featuring four scenarios related to Joint Close Air Support (JCAS) and led by each of the represented Services (Air Force, Army, Navy, and Marine Corps). For the USAF contribution, AFRL/HEA and the Training Systems Product Group demonstrated research and development (R&D) concepts for deployable training and rehearsal.

Low-cost Experimental Deployable Tactical Trainers allowed Viper pilots in Florida to fly in a robust DMO environment with high-fidelity systems located in Arizona. Insets (top to bottom): Maj "Lucky" Quirion and Maj "Cargo" Meleady in Orlando participate in Maj "Bobaloo" Rickard's brief on Working Area tactics from Mesa. DMO scenarios over California database were flown under AWACS control by Lt "Sniper" Haberstroh

Operation Virtual Freedom showcased real-time JCAS mission planning, briefing, execution, and debriefing. Warfighters from each Service operating virtual training systems on the floor at I/ITSEC experienced completely seamless training, from the deployed location to the home station at Mesa Research Site (MRS). Team Mesa demonstrated the capability to use low cost, small footprint deployable DMO training devices in a greater DMO operational environment using commercial networks.

Applying commercial-off-the-shelf (COTS) technologies, Team Mesa enabled the warfighters in Arizona and Florida to conduct multi-point, simultaneous mission planning, briefing, and debriefing. Through innovative use of COTS, distributed users shared audio, video, and data in real-time, a demonstrated capability applicable to live-fly missions. In a trial Coalition Mission Training Research (CMTR) distributed exercise last year, British, Canadian, and USAF warfighters confirmed the COTS brief and debrief system would be a valuable tool for deployed forces worldwide.

Team Mesa supplemented the *Operation Virtual Freedom* JCAS scenarios with daily DMO vignettes briefed and flown by operational F-16 and A-10 pilots supporting the Joint demonstration. Active duty, Air National Guard, and Air Force Reserve Command Viper pilots, all graduates of the USAF Weapons School, flew numerous missions in the high-fidelity simulators at MRS and the deployable devices at the I/ITSEC site. Under control of an Airborne Warning and Control System (AWACS) operator at MRS, four Viper pilots and two Hawg pilots demonstrated how a realistic DMO environment can supplement Combat Air Force (CAF) readiness training.

Maj Scammon, in Mesa's A-10 Full Mission Trainer, attacks targets during the Joint Close Air Support scenario over Southern California database during Operation Virtual Freedom

US and Canada R&D = Simulator Integration

CF-18 pilot: "Viper, check." F-16 pilot: "Two...on your wing, right side"

With that check-in over the COTS simulated radio, a USAF pilot in an F-16C simulator at MRS began a "flight test" with a Canadian pilot in the CF-18 simulator developed and built at MRS then delivered to Defence Research and Development Canada (DRDC)-Toronto. This on-schedule and within-budget delivery enabled opportunities for successful collaboration and ongoing support of CMTR goals. When the legacy Part-Task Trainer at DRDC-Toronto failed to support a two-ship test, Team Mesa quickly networked three of the Viper Multi-Task Trainers (MTT) located in the DMO Testbed to form a four-ship for this short-notice wingman duty. This initial integration test was made possible through the compatible use of Common Core simulation architecture developed at MRS for the DMO program, transitioned to the newly minted CF-18 Hornet MTT prototype, and flown in a virtual operational environment.

While not exactly "starting from scratch," the prototype effort began in early 2001 with delivery of the front-end of a crashed CF-18 and some legacy simulation software. Team Mesa returned the Hornet cockpit to Canada as a fully integrated high-fidelity MTT capable of supporting current and future long haul encrypted networking, control station, briefing/debriefing, threat simulation, and visual system technologies (including low-cost Personal Computer technologies). The CF-18 MTT also includes a real-time mission computer and digital display indicator emulation developed by the Canadian Department of National Defence.

The Canadian system consists of the CF-18 MTT, an instructor operator station, a threat simulator, an image generation system, a visual database, a Mobile Modular Display for Advanced Research and Training (M2DART) 360-degree display developed at MRS, and a full operations and maintenance documentation package –"one of the best ever seen." Once in place at DRDC-Toronto, the device was connected to MRS to test network and encryption systems, avionics, emergency procedures, and weapons delivery modules. A formal "Heat and Light" ceremony with warfighters flying DMO missions in virtual space at the two R&D sites officially celebrated the succesful joint effort.

Developed under a joint US/Canadian Project Arrangement (PA), "Advanced Distributed Mission Training," the CF-18 MTT will be used in a series of international training and mission rehearsal exercises between DRDC-Toronto, AFRL/HEA, and the UK's Defence Science and Technology Laboratory. The PA, signed in September 1999, remains in effect until September 2006, with options to expand through 2008. It covers development of protocols and standards, critical technologies (such as high-fidelity visual and simulation systems), a Canadian testbed of network-capable simulators, and CMTR participation.

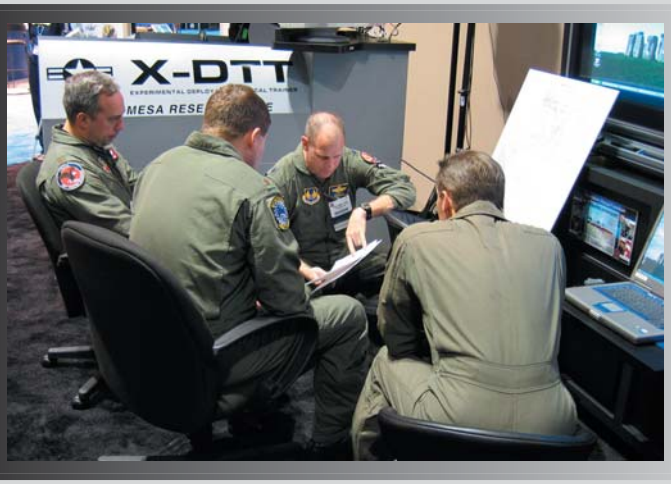
The overwhelming success of this technology demonstrator inspired DRDC to expand their program, laying plans to develop a second CF-18 MTT to support ultra-high resolution laser-based visual R&D. With an eye toward using the CF-18 MTT and M2DART for "Advanced Deployable Day/Night Simulation" R&D, DRDC plans to examine operational training requirements.

Dr. Lochlan Magee, Canadian Program Manager and Head of Simulation and Modeling, congratulates Dr. Byron Pierce, US Program Manager and Team Lead at MRS, on the successful delivery and acceptance of the CF-18 MTT to DRDC-Toronto

TARGETS OF OPPORTUNITY

The Defense Advanced Research Projects Agency (DARPA) Training Superiority Program (DARWARS) is leveraging AFRL/HEA's extensive university partnerships by funding skill decay and team training performance assessments through a university consortium. AFRL/HEA will receive $500K per year for three years to develop skills tracking and proficiency assessment methods using tools in the DARWARS architecture. The effort will involve a number of university partner laboratories, fostered by Team Mesa, conducting a series of local and distributed experiments to assess, track, and monitor skills performance using Jane's Fleet Command©, a COTS interactive combat simulation wargame.

MRS scientists will co-chair the Unmanned Aerial Vehicle (UAV) workshop with Arizona State University-East professors. Seeking to unite training research and UAV communities, the workshop will identify critical human factors and cognitive engineering challenges associated with UAV operations. For example, analogies of UAV operations to manned flights or air traffic control tasks belie efforts to reduce mission support staff and increase number of vehicles to control, as the complexity of UAV operations requires a number of people beyond the immediate crew.



Lt Col "Odie" Park discusses the schedule and DMO demonstration highlights with Majors "Lucky" Quirion, "Bama" Lesman, and "Simple" Symons in Florida prior to planning with teammates at the Mesa Research Site AZ--proper planning yielded MISSION SUCCESS!

Team Mesa successfully installed the first piece of the Warfighter Communication Assessment System (WCAS) in the DMO Testbed. The WCAS, a software program produced by the Crew Systems Interface Division (AFRL/HEC), is an initial speech-to-text application with improved voice recognition capabilities. Using COTS language models and mission data log files from the DMO Control Station, AFRL/HEC experts delivered a transcription application that monitors, time-stamps, and converts warfighter communications to text in real-time during DMO engagements. The next phase in WCAS development will integrate a latent semantic analysis application for use as a "brevity code" communications scoring, instructional, and debriefing aid, and subject-matter experts (SME) will develop and validate scoring criteria to help assess "good, bad, and ugly" mission communications. This process will include an intelligent tool to compare radio calls with operational brevity words, definitions, and communications standards found in Air Force Tactics, Techniques, and Procedures 3-1, employed throughout the CAF.

Joint Forces Air Component Commander Competency-Based Training

USAF Senior Mentors in the Operational Command Training Program shared their Joint Forces Air Component Commander (JFACC) expertise at two Mission Essential Competency (MEC) workshops. The retired three-stars provided insight based on personal experiences in working executive issues while serving as USAF leaders in Air and Space Operations Centers (AOC) during armed conflict. The effort to establish MEC-based training for JFACCs is a "tooth-to-tail" analysis, from top decision makers to the shooters, to determine what competencies, experiences, knowledge, and skills are required for these critical leaders to succeed in combat.

The JFACC is the commander of air assets and answers directly to the Joint Force Commander. JFACC responsibilities include planning, coordination, allocation, and tasking of joint air operations. The AOC is the JFACC's means, or weapon system, to carry out command and control (C2) actions enabling air assets to effectively and efficiently execute the mission designated by the National Command Authority. In the past JFACCs, along with many AOC personnel, did not have an advanced training program tailored to their unique weapon system that was commensurate with established "pipeline" programs for operators of other Major Defense Systems (MDS) such as air and space assets.

While primary MDS assets have fairly mature Mission Qualification Training or Continuation Training requirements, the parallel path for JFACCs and warfighters manning the AOC is relatively new. By defining MECs attributed to highly qualified JFACCs, the AOC training research effort is expected to have a significant influence in improving the comprehensive training programs underway at the C2 Warrior School at Hurlburt Field FL.

Fly by Night Research Initiatives

Completing an eight-year effort, Team Mesa transitioned all documentation, SensorHost software (object code) and hardware to the Aeronautical Systems Center, Training Systems Management Directorate (ASC/YW). This enables implementation of the AFRL-developed Night Vision Training System (NVTS) specifications and documentation for any DoD contract. For example, the US Navy's PMA-205 acquired NVTS to support the F/A-18 simulation program and it is likely the USAF will add NVTS during F-16 Unit Training Device and Weapons System Trainer upgrades.

The NVTS is comprised of simulated Night Vision Goggles (NVG), headtracker, image generator (IG) with material coded database, SensorHost, and the Video Processor for Real-time Simulation (ViPRS), a post-processor board designed and built to AFRL/HEA specifications. The AFRL-developed SensorHost employs a modular architecture independent of any specific IG, and with proper measurements can be programmed to simulate any model of NVG (currently, F4949G NVGs). NVTS is a high fidelity physics-based systems approach to accurately render NVG imagery verified through real-world measurements. It functions by doing radiance-to-luminance mapping, computing proper NVG luminance in real-time for current light conditions, and passing data to the IG. The resultant image appears in a simulated NVG head-mounted display that has the same look and feel as actual goggles.

In concert with the 422 Test and Evaluation Squadron (TES), the "Fly by Night" team conducted the Multi-Mode External Source for Aircraft (M2ESA) lighting system Critical Design Review at Nellis AFB NV. The design passed all necessary shock, vibration, and electromagnetic interference testing, and led to initial production and installation of flightworthy M2ESA equipment on two Nellis F-15C Eagles.

The M2ESA is a remove-and-replace system for traditional external aircraft light fixtures. It includes programmable drive electronics and optics assemblies consisting of three light-emitting diodes (LED) in each wingtip, two LEDs in the tail, and near-infrared (IR) emitters in all three locations, enabling overt and variable covert lighting intensity and flash pattern options for Eagle pilots. In the overt mode, the long-life LED position lights are simultaneously "friendly" to NVGs and compliant with Federal Aviation Administration and International Civil Aviation Organization luminous intensity requirements. In the covert mode, the visible LEDs are not illuminated. The directional near-IR emitters are still visible through airborne NVGs (but are not visible to NVG users on the ground). This enables pilots to see pre-programmable discrimination patterns unique to each aircraft.

Showing remarkable ingenuity, these prototype lights were completely designed, developed, and fabricated under the direction of Team Mesa scientists, engineers, technicians, and SMEs. When transitioned to the operational commands, these lights will provide an answer to a critical wartime mission need at a reasonable cost. A substantial side benefit will be significantly improved mean time between failures (MTBF), as LEDs promise to have as much as 10,000 hours MTBF, orders of magnitude more reliable than current lights.

M2ESA left wingtip device operating in overt mode on F-15C at Nellis AFB. M2ESA device is also capable of covert (near-IR) emissions visible only through NVGs, with covert emitter, drive electronics, and optics integrated into package. Inset: Access panel immediately aft of M2ESA device is opened to make electrical connections during removal and replacement of wingtip light fixture. Note clear lens--LEDs determine the color of emitted light.

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